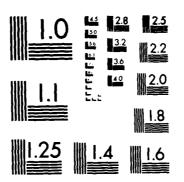
SYSTEM FOR INVESTIGATING SUPERCONDUCTING FILMS WITH SURFACE ACOUSTIC HAVE (U) HISCONSIN UNIV-MILMAUKEE DEPT OF PHYSICS H LEVY 14 JUL 85 AFOSR-TR-62091 AFOSR-84-0221 F/G 28/12 NL UNCLASSIFIED

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dilution refrigerator superconducting films surface acoustic waves superconducting magnet 4.3 millikelvin frequency agile attenuation measurement system frequency agile velocity measurement system (over) 4 Gliz 95 K Gauss submicron photolithography ABSTRACT (Continue on reverse side if necessary and identify by block number DD 1 JAN 73 1473

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18. SUPPLEMENTARY NOTES

A system for investigating superconducting films with surface acoustic waves down to 4.3 millikelvin up to frequencies of 4 GHz and up to magnetic fields of 95 K Gauss has been ordered, received and assembled. A dilution refrigerator has been installed in a new laboratory. It has been tested in place down to 4.3 millikelvin. The refrigerator has a top loading probe with four interchangeable slugs which can be used for different millikelvin temperature experiments. Each slug has 13 electrical leads which can be

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SECURITY CLASSIFICATION OF THIS PAGE(When Date Entered)

19. Key Words - continued 0.3  $\mu m$  interdigital electrodes transducers helium lambda tip

,20. Abstract - continued

connected at millikelvin temperatures. A superconducting magnet has been obtained which has been tested up to 95 K Gauss in conjunction with a helium lambda tip. All the parts for an automatic ultrasonic attenuation and velocity system in the frequency range of 10 MHz to 4000 MHz have been ordered and assembled. Parts for the submicron photolithography subsystem required to reproduce masks with linewidths of 0.3  $\mu$  which will be used for making interdigital electrodes which will act as transducers to launch surface acoustic waves in the GHz range have been received and assembled.



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# RESEARCH OBJECTIVES AND APPROACHES

The objective of this DoD-URIP effort is to install a research system for investigating superconducting films with surface acoustic waves down to temperatures of 4.5 millikelvin, up to frequencies of 4 GHz and up to magnetic fields of 90 K Gauss. A dilution refrigerator would be used for obtaining temperatures in the millikelvin range. A superconducting magnet would be used for attaining the magnetic fields. A frequency agile attenuation and velocity measurement system which covers the frequency range from 10 to 4,000 MHz will be assembled for producing and detecting the electromagnetic signals required to make the measurements. And, a submicron photolithography system would be acquired that would permit contact reproduction of masks with line widths of 0.3  $\mu$ . This photolithography system is required for producing the interdigital electrodes that are used as transducers for producing surface acoustic waves in the GHz frequency range.

#### ACCOMPLISHMENTS

A dilution refrigerator has been purchased from Oxford Instruments. It has been installed in a new laboratory in the basement of the Physics Building. A pit nine feet deep by 2-1/2 feet wide by 10 feet long has been excavated and finished to house the dewar. A housing has been installed in a room above the laboratory to permit a probe to change samples and experiments while the dilution refrigerator is operating at millikelvin temperatures. The installation of the dilution refrigerator required having 26 clear feet of vertical space. The dilution refrigerator has been tested and it achieved a temperature of 4.3 millikelvin. The top loading probe was satisfactorily tested. Four slugs and a housing for performing different millikelvin experiments have been machined at UWM. Each slug has 13 independent electrical connections which can be engaged to the housing at low temperatures.

A superconducting magnet was obtained from Oxford Instruments, which together with a helium lambda tip was tested up to fields of 95 K Gauss.

A Hewlett Packard computer has been obtained which will run the ultrasonic measuring equipment and monitor the dilution refrigerator.

All the parts required to assemble and build the automatic ultrasonic attenuation and velocity measurement system have been purchased and delivered. The system has been assembled on a breadboard and satisfactorily tested. It is now being installed into its permanent configuration.

The flowbooth, illuminator and millipore water treatment system for the submicron photolithography sybsystem have been ordered and, delivered. They are presently being installed and tested.

## TECHNICAL PERSONNEL

In addition to the principal investigator, the following technical personnel have worked on this grant. All these personnel have been university supported when they worked on this grant.

#### **Faculty**

Dr. Bimal Sarma

(Assistant Professor)
Dilution refrigerator

## Postdoctoral Fellow

Dr. Qiang Yong Jia

(Visiting Research Fellow)
Dilution refrigerator

## Graduate Students

Mr. Roy Wiegert

(Graduate Student)

Automatic attenuation and velocity measuring

system.

Mr. Anders Schenstrom

(Graduate Student)

Computer specification and installation.

#### <u>Technicians</u>

CHANGE CONTRACT STRAIGHT CONTRACT CONTRACTOR

Mr. John Jacobs

(Instrument Maker)

Part-time on this project. Dilution refrigerator.

Mr. Michael Mitchell

(Machinist and Technician - Part time on this project.

Dilution refrigerator, ultrasonic attenuation

and velocity measuring system, submicron

photolithography.

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